

Water Supply & Sanitary Engineering (DI05006021)

Unit 10: Maintenance of Sewage System

Lecture 41: Maintenance Procedures, Causes of Trouble, and
Cleaning

GTU Diploma Engineering

Agenda

- Importance of Sewer Maintenance
- Common Causes of Trouble in Sewers
- Routine and Preventive Maintenance Procedures
- Sewer Inspection Techniques
- Methods of Cleaning Sewers
- Flushing Operations

Importance of Sewer Maintenance

- Preventive maintenance avoids costly emergency repairs and sudden system failures.
- Ensures unhindered flow of sewage, preventing backflow into streets or basements.
- Reduces the generation of noxious or explosive sewer gases like Hydrogen Sulfide (H_2S) and Methane (CH_4).
- Extends the physical lifespan of the sewer infrastructure by preventing corrosion and structural damage.
- Protects public health by preventing the overflow of untreated wastewater into the environment.

Causes of Trouble: Structural Failures

- Pipe Cracking and Collapse: Caused by excessive surface loads, poor bedding, or shifting soil.
- Joint Failures: Improperly sealed joints can open up due to ground settlement, leading to leakage or infiltration.
- Corrosion: Crown corrosion in concrete pipes is caused by sulfuric acid formed from Hydrogen Sulfide (H_2S) gas.
- Misalignment: Earth movements can cause pipes to shift out of alignment, creating dips or 'bellies' where solids settle.

Causes of Trouble: Blockages and Obstructions

- Fats, Oils, and Grease (FOG): Solidify when cooled, clinging to pipe walls and restricting flow.
- Root Intrusion: Tree roots seek moisture and nutrients, entering through tiny cracks or joints and growing into massive webs.
- Debris and Silt accumulation: Sand, grit, and street debris entering through catch basins or manholes.
- Foreign Objects: Rags, plastics, and non-biodegradable items inappropriately flushed down household drains.

Causes of Trouble: Infiltration and Inflow (I&I)

- Infiltration: Groundwater entering the sewer system through defective pipes, pipe joints, and manhole walls.
- Inflow: Surface runoff entering directly through manhole covers, cross-connections with storm drains, or roof downspouts.
- Impact: Surcharges the sewer lines beyond their design capacity, leading to overflows.
- Dilutes sewage, which increases the pumping and treatment costs at the wastewater treatment plant.

Maintenance Procedures: Routine Inspection

- Visual Inspection: Regularly checking manholes for flow conditions, odor, and structural integrity.
- Lamp Inspection: Shining a bright light from one manhole to another to check for a clear line of sight, indicating a straight and clear pipe.
- CCTV Inspection: Using remote-controlled closed-circuit television cameras to record the internal condition of pipes.
- Smoke Testing: Forcing non-toxic smoke into lines to identify sources of inflow and illegal connections (smoke will escape from illegal surface drains).

Maintenance Procedures: Preventive and Corrective

Concept 1

Concept 2

Preventive Maintenance: Scheduled activities to prevent failures. Includes periodic flushing, root chemical treatment, and regular pumping station checks.

Corrective Maintenance: Unscheduled activities to restore a failed system. Includes emergency unblocking, repairing collapsed pipes, and replacing broken manhole covers.

A good maintenance program should consist of 75-80% preventive and 20-25% corrective tasks.

Cleaning Sewers: Flushing Operations

- Objective: To remove accumulated silt, sand, and light organic matter by creating a high-velocity flow.
- Method: Water is suddenly released into the sewer from a fire hydrant, water tank, or an automatic flushing tank.
- Mechanism: The sudden surge of water creates a velocity greater than the self-cleansing velocity, scouring the invert.
- Limitation: Flushing is only effective for flat grades and small debris; it cannot remove hardened grease, roots, or heavy solid blockages.

Cleaning Sewers: Mechanical Cleaning (Rodding)

- Use of flexible steel rods pushed into the sewer to dislodge blockages.
- Various tools can be attached to the end of the rod: augers (for boring through grease), root saws (for cutting roots), and sand cups.
- Power Rodding machines use motors to rotate the rods, providing enough torque to cut through stubborn root masses.
- Particularly effective for clearing complete blockages in small to medium-diameter pipes.

Cleaning Sewers: High-Velocity Water Jetting

- Also known as Hydro-Jetting.
- Uses a high-pressure water pump, a hose, and a specialized nozzle.
- Water is pumped at 1000 to 3000 psi. The nozzle has rear-facing jets that propel the hose forward while scouring the pipe walls.
- As the hose is pulled back, the high-pressure water washes debris, grease, and silt back to the manhole where it is removed.
- Highly effective for grease removal and general preventative pipe washing.

Cleaning Sewers: Bucket Machines

- Used for removing heavy debris, sand, and gravel from large diameter sewers.
- Involves two powered winches set up over adjacent manholes.
- A cable is threaded through the sewer line connecting the two winches.
- A specialized bucket is pulled into the debris. Its jaws open to collect the debris and close when pulled backward, bringing the material to the surface.
- Usually preceded by rodding to thread the initial cable through.

Chemical Cleaning and Root Control

- Chemical Herbicides: Used to kill intrusive roots without harming the entire tree above ground.
- Application: Typically applied as a dense foam that fills the pipe, coating the roots completely.
- Grease Control: Bio-additives or chemical degreasers can be injected to break down hardened FOG.
- Odor Control: Addition of chemicals like hydrogen peroxide or chlorine to oxidize hydrogen sulfide and reduce foul odors.

Summary

- Sewer maintenance is critical to prevent blockages, overflows, and structural failures.
- Common troubles include FOG, root intrusion, structural cracking, and excessive Infiltration/Inflow.
- Inspection methods like CCTV and smoke testing help identify issues accurately.
- Cleaning techniques range from simple flushing to advanced high-velocity water jetting, power rodding, and bucket machines.
- A combination of mechanical and chemical methods provides the most comprehensive maintenance strategy.

Next Lecture Preview

- Maintenance Equipment and Selection
- Understanding exactly what machines to use for specific problems.
- Safety Measures in Sewer Maintenance
- Exploring confined space entry, gas detection, and Personal Protective Equipment (PPE).